

# Frequency of Nonunion in Open Fractures of Tibia Treated With AO External Fixator

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## ABSTRACT

**Aim:** To determine the frequency of non union in open fracture of tibia fibula treated with AO external fixator.

**Setting:** Department of Orthopedic Surgery, Khawaja Muhammad Safdar Medical College, Sialkot.

**Duration of study:** 18 months (18 December 2016 to 17 June 2018)

**Results:** According to our study, mean age of male patients was 33.87 (SD± 8.82) and in female patients mean age of patients was 34.31 (SD± 8.728). Out of 114 (100%), 60 (52.7%) were male and 54 (47.4%) were female. Similarly when we calculate time since injury, 39 (34.2%) patients were presented after 24 hours of injury, 40 (35.1%) after 48 hours and 35 (30.7%) after 72 hours since injury. As concern to the site of fracture out of 114 patients 39 (34.2%) were have upper third site, 38 (33.3%) were have Middle third and 37 (32.5%) were have lower third site of injury. When we calculated outcome variable, non union was present in 19 (16.7%) and absent in 95 (83.3%) patients.

**Conclusion:** AO External fixator is a successful technique in the managing the patients with open tibial fractures.

**Keywords:** Open Fracture, Tibia Fibula, AO External Fixator, Non Union.

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## INTRODUCTION

Tibia being located subcutaneously is liable to fractures frequently and these fractures are mostly open. Road traffic accidents, injuries during skiing, and falls from height are the usual causes. The quantum of force causing injury will determine the fracture anatomy (e.g., skiing injuries lead to spiral fractures).<sup>1</sup> Mostly fractures are comminuted. Examination of the limb include complete examination of the blood vessels, colour of the limb, temperature and perfusion, distal pulses, capillary filling (normal < 3 seconds), pulse oximetry and pulse wave forms. The examination of nerves to record the sensations and motor function is mandatory. Skin overlying the fracture must be examined with care. Loss of integrity of skin near the fracture is usually an indication of possibility of fracture to be open. Also it is to be kept in mind; the wounds at distance from the fracture may communicate with the it. Open fractures nearby joints almost always contaminate with the associated joints. Signs of crush injury and damage to muscles and compartment syndrome should be looked for as these injuries may exhibit few signs on examination<sup>2</sup>.

The evidence of compartment syndrome is high in patients who are inflicted with high-energy tibial fractures. It is important to note; even open fractures are associated with compartment syndrome. These patients need surgical debridement and stabilization, doing a fasciotomy and release of compartment is dire required<sup>3,4,6</sup>.

External fixation for the open fractures has a role in modern era of traumapatients' management and studies

have been published about its use in multiply injured patients having associated of soft tissue problems. However, the results of these studies were controversial in various studies. In one study conducted by Papaioannou et al. reported that there was 20.3% non union in tibial fractures treated with AO external fixator.<sup>7</sup> In another study conducted by Michail Beltsios et al. the frequency of non union among patients with open fracture of tibia treated with AO external fixation was 8.07%.<sup>8</sup> In another Iranian study which compared AO external fixation with Illizarov fixator, non union was found in 11.7% versus 10% among AO and Illizarov fixator<sup>9</sup>. In another study published in Pakistan Journal of Biology and Sciences the reported rate of malunion in tibial shaft fracture treated by AO external fixator was reported to be 8%<sup>10</sup>. We want to identify the frequency of non-union in our population with open tibial diaphyseal fractures which if found to be low will help us recommend the routine use of this technique in our patients and if found to be high will enable us improve our surgical techniques and use alternative treatment options in this patient group. No study on the subject has been conducted in our set up so we wanted to collect data and analyse it.

## PATIENTS AND METHODS

We enrolled 114 patients in this study. The patients with tibial fractures included both genders, age between 20-50 years and were diagnosed as open diaphyseal fractures of the tibia. Time since injury was less than 72 hours and patients with Gustilo type II i.e. more than 1cm long but without extensive soft tissue damage. The patients excluded from the study were previous tibial fracture,

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pathological fracture, history of malignancy and with decompensated cardiopulmonary disease. Study was conducted with approval from the ethical committee of the institute. Consecutive 114 patients fulfilling the criteria for inclusion in the study, got admission through the causality department outpatient department were included. Informed written consent was taken from all the patients. Complete history of injury and detailed physical examination was carried out. Laboratory investigations including blood complete picture, renal function tests as serum creatinine, urea, electrolytes, blood glucose, hepatic profile as liver function test and anteroposterior as well as lateral radiographs of the tibia and Fibula were done in all the patients to confirm the diagnosis. All the patients were operated and surgeries were done by a consultant orthopedic surgeon with a post fellowship experience of minimum 5 years. Patients were managed and monitored for 1 week as admitted in the orthopedics ward and were discharged thereafter. They were regularly followed up and final outcome was assessed in terms of presence or absence of non-union at 16 weeks on AP and lateral X-rays of the tibia and Fibula. Those not completing follow up were excluded from the study

**RESULTS**

The mean age in male patients was 33.87±8.82, and in female patients was 34.31±8.72. Out of 114(100%), 60(52.7%) were male and 54(47.4%) were female. Similarly when we calculate time since injury, 39(34.2%) were presented within 24 hours of injury, 40(35.1%) within 48 hours and 35(30.7%) within 72 hours since injury. Regarding the site of fracture, 39(34.2%) had upper third site, 38 (33.3%) had middle third and 37(32.5%) had lower third site of injury. When we calculate outcome variable (Non union), it was present in 19(16.7%) and absent in 95(83.3%) of patients.

Table 1: General statistics

Total patients in study	114	
Male: female	60:54	52.6: 47.4
Age	19-62 yrs	Mean (32±9.62 yrs)
Time since injury- <24 hrs	39	34.21%
Time since injury- 24-48 hrs	40	35.08%
Time since injury- 48-72 hrs	35	30.70%
Diabetes	19	16.66%
Hypertension	17	14.91%
Smoking	29	25.43%

Site involved

Table II- frequency of sites involved

Upper Third	39	34.2 1%
Middle Third	38	33.33%
Lower third	37	32.5 2%

Table III- morbidity data

Wound infection	2	1.75%
Malunion	3	2.63%
Non union	19	16.66%
Mortality	0	0

**DISCUSSION**

The frequency of Tibial shaft fractures amount to 9.0% of total fractures.<sup>11</sup> Open fractures of the tibia show a high-

energy injury to soft tissue and bone with ensuring problems of infection and poor bone healing.<sup>12</sup> Unilateral, uniplanar external fixation provided good early stability in open fracture tibia, so that our patients could walk with full weight-bearing at a mean 3.8 weeks after injury. According to our study, mean age of male patients was 33.87 (SD± 8.825) and in female patients was 34.31( SD± 8.728). Out of 114 (100%), 60 (52.7%) were male and 54 (47.4%) were female.

This findings are comparable to the study of Makhdoom et al<sup>13</sup> that shows 60(88.24%) males and 8(11.76%) female patients. Our results of gender involved insuffering such fractures can be compared with that of Moda et al<sup>14</sup>. Our results compare well with those of other series of similar fractures treated by external fixation<sup>15,16</sup>. They also compare well with the results reported by Clifford et al<sup>17</sup> who used plate fixation for open tibial fractures. They found union at 20 week in 55.7% of patients and at 30 week in 79.5%; these figures compare with 76.7% and 97.3% respectively in our series. In our study we calculated outcome variable (Non union) out of 114, non union was present in 19 (16.7%) and absent in 95 (83.3%) of patients. They had 2 cases (4.0%) of non union, which required secondary procedures for achieving union. Iqbal et al<sup>18</sup> and Khan et al<sup>19</sup> reported 14.2%, 9.6% and 5% in sequence rates of non union in type II open tibial fractures in their series.

In male gender with age of 20-30 years, non union was found in 7 cases and absent in 17 cases. In female gender, it is found in 4 cases and absent in 16 patients. Similarly male patients with age of 31-40 years were having non union in 4 cases and absent in 16 cases. On the other hand in female also 4 patients were having non union and absent in 16 cases. We concluded that unilateral, uniplanar external frame fixation with early bone grafting is considered the best method of management for open tibial fractures in our community.

Early weight-bearing and our patients' ability to squat and sit cross-legged on the ground for the activities of their daily living allowed early discharge from hospital. Since these are distinct advantages over other methods of treatment, external fixation has become a readily acceptable form of treatment for open tibial fractures in our community.

Nonunionin fractures of fibula shows instability of the concomitant fracture of tibia.<sup>19</sup>Fleming noted a 2.4% reoperation rate whereas in a recent analysis 68.5% of the fractures required at least one further operation before union was achieved. In another study bone graft was used in six cases (2.72%) while the published incidence of bone grafting is 45% currently.

**CONCLUSION**

AO external fixator is good option for open fracture tibia fibula. It is easy and safe in application, cost effective as compared to other fixators, less operating time, shorter hospitalization, with a low and acceptable rate of non-union.

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## REFERENCE

1. Giannoudis PV, Papakostidis C, Kouvidis G, Kanakaris NK. The role of plating in the operative treatment of severe open tibial fractures: a systematic review. *IntOrthop*. 2009;33(1):19-26.
2. Tripuraneni K, Ganga S, Quinn R, Gehlert R. The effect of time delay to surgical debridement of open tibia shaft fractures on infection rate. *Orthopedics*. 2008;31(12):23-8.
3. Giannoudis PV, Harwood PJ, Kontakis G, Allami M, Macdonald D, Kay SP, et al. Long-term quality of life in trauma patients following the full spectrum of tibial injury (fasciotomy, closed fracture, grade IIIB/IIIC open fracture and amputation). *Injury*. 2009;40:213-9.
4. Agrawal A, Chauhan VD, Maheshwari RK, Juyal AK. Primary Nailing in the Open Fractures of the Tibia-Is it worth?. *J ClinDiagn Res*. 2013;7(6):1125-30.
5. Roseiro LM, Neto MA, Amaro A, Leal RP, Samarra MC. External fixator configurations in tibia fractures: 1D optimization and 3D analysis comparison. *Comput Methods Programs Biomed*. 2014;113:360-70.
6. Cannada LK, Anglen JO, Archdeacon MT, Herscovici D, Ostrum RF. Avoiding complications in the care of fractures of the tibia. *J Bone Joint Surg Am*. 2008;90(8):1760-8.
7. Papaioannou N, Mastrokalos D, Papagelopoulos PJ, Tyllianakis M, Athanassopoulos J, Nikiforidis PA, et al. Nonunion after primary treatment of tibia fractures with external fixation. *Eur J OrthopSurgTraumatol*. 2001;11:231-5.
8. Beltsios M, Savvidou O, Kovanis J, Alexandropoulos P, Papagelopoulos P. External fixation as a primary and definitive treatment for tibialdiaphyseal fractures. *Strategies Trauma Limb Reconstr*. 2009;4(2):81-7.
9. EsmailnejadGanji SM, Bahrami M, Joukar F. IlizarovVersus AO External Fixator for the Treatment of Tibia Open Fractures. *Iran Red Crescent Med J*. 2011;13(12):868-72.
10. Mohseni MA, Soleimanpour J, Mohammadpour H, Shahsavari A. AO tubular external fixation vs. unreamed intramedullary nailing in open grade IIIA-IIIB tibial shaft fractures: A single-center randomized clinical trial. *Pak J Biol Sci*. 2011;14:490-5.
11. Garcia Juarez JD, Aguilera Zepeda JM, Bienvenu AT. Encalada Diaz MI, Sheldon OD. Use of the orthofix intramedullary nail in tibial shaft fractures. A review of 22 cases. *ActaOrthopMex* 2007;21: 212-6.
12. Shannon FJ, Mullett H, O'Rourke K. Unreamed intramedullary nail versus external fixation in grade III open tibial fractures. *J Trauma*. 2002; 52(4):650-654.
13. Makhdoom A, Laghari MA, Qureshi PAL, Siddiqui KA. Management of open diaphyseal fractures of tibia treated by naseerawais external fixator. *The J of Pak Orthopaedic Assoc* 2006; 18(1).
14. Moda SK, Kalra GS, Gupta RS, Maggu NK, Gupta RK, Kalra MK. The role of early flap coverage in the management of fractures of both bones of leg. *Injury* 1994;25:83-86.
15. O'Sullivan ME, Chao EY, Kelly PJ. The effects of fixation on fracture- healing. *J Bone Joint Surg [Am]* 1989; 71-A:306-10.
16. Nesbakken A, AUto A, Bjersand AJ, Jensen DK, Stangeland L, Walloe A. Open tibial fractures treated with Hoffman external fixation. *Arch Orthop Trauma Surg* 1988; 107:248-52.
17. Clifford RP, Beauchamp CG, Kellam JF, Webb JK, Tile M. Plate fixation ofopen fractures of the tibia. *J Bone Joint Surg [Br]* 1988; 70-B:644-8.
18. Iqbal MJ, Cheema GM, Akhtar S, Awais SM, Akhtar NM. Complications of the AO external fixator in open type 111 tibial fracture. *Pak J Orthop* 1996;12(3):120-123.
19. Khan MA, Khan SW, Qadir RI. Role of external fixator in the management of type 11 & 111 open tibial fractures. *J Postgraduate Med Inst* 2004; (18)1: 12-17.